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Using the satellite data to determinate the regional land surface heat fluxes over heterogeneous landscape of the Tibetan Plateau

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As the most prominent and complicated terrain on the globe, the Tibetan Plateau, with an elevation of more than 4000 m on average above mean sea leave (*msl*) makes up approximately one fourth of the land area of China. Due to its heterogeneous topographic characteristics, the plateau surface absorbs a large amount of solar radiation energy, and undergoes dramatic seasonal changes of surface heat and water fluxes. The lack of quantitative understanding of interactions between the land surface and atmosphere makes it difficult to understand the complete energy and water cycles over the Tibetan Plateau and their effects on global climate change with numerical models. The study on the regional distribution of land surface heat fluxes is of paramount importance for the study of interactions between the land surface and atmosphere over heterogeneous landscape of the Tibetan Plateau. How can we determine the regional heat fluxes over heterogeneous landscape of the Tibetan Plateau? Remote sensing from satellites offers the possibility to derive regional distribution of land surface heat fluxes over heterogeneous land surfaces.

In this study, parameterization methods based on satellite data (NOAA/AVHRR, Landsat-7 ETM, ASTER and MODIS) and Atmospheric Boundary Layer (ABL) observations have been proposed and tested for deriving surface reflectance, surface temperature, NDVI, MSAVI, vegetation coverage, LAI, net radiation flux, soil heat flux, sensible heat flux and latent heat flux over heterogeneous landscape. As cases study, the methods were applied to the experimental area of the CAMP/Tibet (CEOP (Coordinated Enhanced Observing Period) Asia-Australia Monsoon Project (CAMP) on the Tibetan Plateau), which located at the central Tibetan Plateau and the whole Tibetan Plateau area. Five scenes of Landsat-7 ETM data, four scenes of NOAA/AVHRR data, four scenes of MODIS data and three scenes of ASTER data were used in this study. To validate the proposed methods, the ground-measured surface reflectance, surface temperature, net radiation flux, soil heat flux, sensible heat flux and latent heat flux are compared to satellite derived values. The results show that the derived surface variables and land surface heat fluxes over the study area are in good accordance with the land surface status. These parameters show a wide range due to the strong contrast of surface features. And the estimated land surface variables and land surface heat fluxes are in good agreement with ground measurements, and all their absolute percent difference is less than 10% in the validation sites. It is therefore concluded that the proposed methods are successful for the retrieval of land surface variables and land surface heat fluxes over the heterogeneous landscape of the Tibetan Plateau area.